

IN THE CLAIMS

1. (Currently Amended) An image processing method of quantizing multi-tone image data by an error diffusion method, comprising the steps of:

- a) detecting change of the image data; and
- b) oscillating cyclically in image space a threshold for the quantization in an oscillation range controlled according to the detection result of the step a),
wherein the step a) detects an edge degree of the image data by detecting change of the image data; and
the step b) controls the oscillation range of the quantization threshold according to the edge degree in multi-steps.

2. (Canceled)

3. (Original) The image processing method as claimed in claim 1, wherein the step a) detects cyclicity of change of the image data by detecting change of the image data.

4. (Original): The image processing method as claimed in claim 1, wherein the step a) detects an edge degree of the image data and cyclicity of change of the image data by detecting change of the image data.

5. (Original) The image processing method as claimed in claim 1, wherein:
the step a) detects an edge degree of the image data by detecting change of the image data, and performing region expansion processing on the detected edge degree; and
the step b) controls in multi-steps the oscillation range of the quantization threshold according to the edge degree having undergone the region expansion processing.

6. (Original) The method as claimed in claim 5, wherein an expansion extent of the region expansion processing is selected to be within 0.5 mm in the image space.

7. (Original) The method as claimed in claim 1, wherein:

the quantization threshold oscillates approximately around the central value of the data range of the image data;

the maximum oscillation range of the quantization threshold is equal to or larger than 1/3 the data range of the image data; and

the image data is quantized into two levels.

8. (Currently Amended) An image processing apparatus, comprising:

an error diffusion processing part which quantizes image data by an error diffusion method;

an image data change detecting part which detects change of the image data; and

a quantization threshold generating part which generates a quantization threshold for said error diffusion processing part, the quantization threshold oscillating in an oscillation range controlled according to the detection data output by said image data change detecting part,

wherein said image data change detecting part outputs detection data indicating an edge degree of the image data; and

said quantization threshold generating part controls in multi-levels the quantization threshold according to the detection data output from said image data change detecting part.

9. (Canceled)

10. (Original) The apparatus as claimed in claim 8, wherein:

 said image data change detecting part comprises a part detecting an edge degree of the image data, and a part performing region expansion processing on the edge degree, and outputs detection data indicating the edge degree having undergone the region expansion processing; and

 said quantization threshold generating part controls the oscillation range of the quantization threshold according to the detection data output by said image data change detecting part.

11. (Original) The apparatus as claimed in claim 10, wherein an expansion extent of the region expansion processing is selected to be within 0.5 mm in the image space.

12. (Currently Amended) The apparatus as claimed in claim [[9]] 8, wherein said quantization threshold generating part comprises:

 a first part generating a first fluctuating value which oscillates in a fixed oscillation range cyclically in the image space;

 a second part generating a second fluctuating value obtained from multiplying the first fluctuating value generated by said first part by a multiplication factor according to the detection data output by said image data change detecting part; and

 a third part generating the quantization threshold obtained from adding a fixed value to the second fluctuating value generated by said second part.

13. (Original) The apparatus as claimed in claim 10, wherein said quantization threshold generating part comprises:

a first part generating a first fluctuating value which oscillates in a fixed oscillation range cyclically in the image space;

a second part generating a second fluctuating value obtained from multiplying the first fluctuating value generated by said first part by a multiplication factor according to the detection data output by said image data change detecting part; and

a third part generating the quantization threshold obtained from adding a fixed value to the second fluctuating value generated by said second part.

14. (Currently Amended) The apparatus as claimed in claim [[9]] 8, wherein said quantization threshold generating part comprises:

a first part generating a plurality of fluctuating values which oscillate in respective different oscillation ranges cyclically in the image space; and

a second part selecting from the plurality of fluctuating value a fluctuating value having an oscillation range according to the detection data output by said image data change detecting part.

15. (Original) The apparatus as claimed in claim 10, wherein said quantization threshold generating part comprises:

a first part generating a plurality of fluctuating values which oscillate in respective different oscillation ranges cyclically in the image space; and

a second part selecting from the plurality of fluctuating value a fluctuating value having an oscillation range according to the detection data output by said image data change detecting part.

16. (Original) The apparatus as claimed in claim 8, wherein:

the quantization threshold oscillates approximately around the central value of the data range of the image data;

the maximum oscillation range of the quantization threshold is equal to or larger than 1/3 the data range of the image data; and

the image data is quantized into two levels.

17. (Original) The apparatus as claimed in claim 8, further comprising a part forming an image according to quantized image data obtained as a result of image data being quantized by said error diffusion part.

18. (Original) The apparatus as claimed in claim 8, further comprising a part inputting multi-tone image data by scanning an original image.

19. (Original) The apparatus as claimed in claim 8, further comprising:
a part inputting multi-tone image data by scanning an original image; and
a part forming an image according to quantized image data obtained as a result of image data being quantized by said error diffusion part.

20. (Currently Amended) A computer readable recording medium in which a program is recorded, the program being read therefrom and executed by a computer so as to cause said computer to perform the functions of:

an error diffusion processing part which quantizes image data by an error diffusion method;

an image data change detecting part which detects change of the image data; and

a quantization threshold generating part which generates a quantization threshold for said error diffusion processing part, the quantization threshold oscillating in an oscillation range controlled according to the detection data output by said image data change detecting part,

wherein said image data change detecting part outputs detection data indicating an edge degree of the image data; and

said quantization threshold generating part controls in multi-levels the quantization threshold according to the detection data output from said image data change detecting part.

21. (Canceled)

22. (Original) The apparatus as claimed in claim 20, wherein:

 said image data change detecting part comprises a part detecting an edge degree of the image data, and a part performing region expansion processing on the edge degree, and outputs detection data indicating the edge degree having undergone the region expansion processing; and

 said quantization threshold generating part controls the oscillation range of the quantization threshold according to the detection data output by said image data change detecting part.

23. (Currently Amended) The recording medium as claimed in claim [[21]] 20, wherein said quantization threshold generating part comprises:

 a first part generating a first fluctuating value which oscillates in a fixed oscillation range cyclically in the image space;

a second part generating a second fluctuating value obtained from multiplying the first fluctuating value generated by said first part by a multiplication factor according to the detection data output by said image data change detecting part; and

a third part generating the quantization threshold obtained from adding a fixed value to the second fluctuating value generated by said second part.

24. (Original) The recording medium as claimed in claim 22, wherein said quantization threshold generating part comprises:

a first part generating a first fluctuating value which oscillates in a fixed oscillation range cyclically in the image space;

a second part generating a second fluctuating value obtained from multiplying the first fluctuating value generated by said first part by a multiplication factor according to the detection data output by said image data change detecting part; and

a third part generating the quantization threshold obtained from adding a fixed value to the second fluctuating value generated by said second part.

25. (Currently Amended) The recording medium as claimed in claim [[21]] 20, wherein said quantization threshold generating part comprises:

a first part generating a plurality of fluctuating values which oscillate in respective different oscillation ranges cyclically in the image space; and

a second part selecting from the plurality of fluctuating value a fluctuating value having an oscillation range according to the detection data output by said image data change detecting part.

26. (Original) The recording medium as claimed in claim 22, wherein said quantization threshold generating part comprises:

a first part generating a plurality of fluctuating values which oscillate in respective different oscillation ranges cyclically in the image space; and
a second part selecting from the plurality of fluctuating value a fluctuating value having an oscillation range according to the detection data output by said image data change detecting part.

27. (Original) An image processing apparatus comprising:

an error diffusion processing part which quantizes multi-tone image data by an error diffusion method; and

a quantization threshold generating part which generates a quantization threshold for said error diffusion processing part, the quantization threshold oscillating cyclically, wherein said quantization threshold generating part generates the quantization threshold using a dither threshold matrix for forming halftone spots at an image space frequency in a range of 100 cycles per inch through 250 cycles per inch.

28-32. (Canceled)

33. (Original) The apparatus as claimed in claim 27, further comprising an edge detecting part detecting an edge level of the image data input to said error diffusion processing part,

wherein an oscillation range of the quantization threshold is controlled according to the edged level detected by said edge detecting part.

34-36. (Canceled)

37. (Original) The apparatus as claimed in claim 27, further comprising an edge detecting part detecting an edge level of the image data input to said error diffusion processing part and a region expansion processing part performing region expansion processing on the edge level detected by said edge detecting part,

wherein an oscillation range of the quantization threshold is controlled according to the edged level having undergone the region expansion processing performed by said region expansion processing part.

38-42. (Canceled)

43. (Original) A computer readable recording medium in which a program is recorded, the program being read therefrom and executed by a computer so as to cause said computer to perform the functions of:

an error diffusion processing part which quantizes multi-tone image data by an error diffusion method; and

a quantization threshold generating part which generates a quantization threshold for said error diffusion processing part, the quantization threshold oscillating cyclically, wherein said quantization threshold generating part generates the quantization threshold using a dither threshold matrix for forming halftone spots at an image space frequency in a range of 100 cycles per inch through 250 cycles per inch.

44-73. (Canceled)